Response To Office Action Mailed November 25, 2002

A. Pending Claims

Claims 2309-2316, 2318-2355, 2357-2385, and 5150-5171 are currently pending. Claims 2309-2311, 2318, 2320, 2332, 2340-2343, 2348-2350, 2357, 2359, 2371, 2378-2382, 5152-5154, 5157-5161, 5163, 5164, 5166, and 5167 have been amended. Claims 2310, 2311, 2318, 2320, 2332, 2340-2343, 2349, 2350, 2357, 2359, 2371, 2378-2382, 5154, 5159, 5161, 5164, 5166, and 5167 have been amended for correction of typographical errors and/or for clarification. Claims 2317 and 2356 have been cancelled. Claims 5172 and 5173 are new

B. Submission of Corrected Formal Drawings

In the Office Action mailed November 25, 2002, the Examiner indicated approval of the proposed drawing corrections filed on March 13, 2002. Applicant submits the corrected formal drawings approved by the Examiner (seven sheets, including FIGS. 23a, 23b, 32, 44, 54, 55, 59, 60, and 63). Applicant is also submitting a marked-up copy of FIG. 21, as well as a formal sheet of drawings with the changes made to FIG. 21.

C. The Claims Are Definite Pursuant To 35 U.S.C. § 112, Second Paragraph

The Examiner rejected claims 5152, 5153, 5154, 5157-5159, and 5163 under 35 U.S.C. § 112, second paragraph, "as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicant regards as the invention."

The Examiner states: "Claims 5152 and 5153 are deemed incomplete and therefore indefinite insofar as there is no step of initially establishing 'a pyrolysis zone', as called for in lines 1 and 2 of the claims. This rejection could be overcome, however, by, amending lines 1 and 2 of claim 5152 to read -- wherein a pyrolysis zone is established in the part of the formation --, and amending lines 1 and 2 of claim 5153 to read wherein a pyrolysis zone is established in

the part of the formation proximate to and/or surrounding at least one of the heaters --." The Examiner further states: "Claims 5157, 5158, and 5163 are similarly indefinite and/or incomplete in failing to initially establish 'a pyrolysis zone.'" Claims 5152, 5153, 5157, 5158, and 5163 have been amended as indicated by the Examiner.

D. Provisional Double Patenting Rejection

The Examiner provisionally rejected claims 2309-2385 and 5150-5171 under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims of copending U.S. Patent Application No. 09/841,293. Upon issuance of a patent for U.S. Patent Application No. 09/841,293 or the present application, or upon both applications being in condition for allowance but for the provisional double patenting rejection, Applicant will provide arguments for the inappropriateness of the double patenting rejection and/or provide a terminal disclaimer for the patent and/or patent applications.

E. The Claims Are Not Anticipated by Ljungstrom Pursuant To 35 U.S.C. § 102(b), or in the Alternative, Are Not Obvious Over Ljungstrom Pursuant To 35 U.S.C. § 103(a)

The Examiner rejected claims 2309, 2310, 2311, 2316, 2319, 2321-2331, 2333, 2334, 2342-2344, 2348, 2349, 2350, 2355, 2358, 2360-2370, 2372, 2373, 2181, 2382, 5151-5154, 5156-5163, 5165, 5166, and 5168-5170 under 35 U.S.C. § 102(b) as anticipated by, or in the alternative, under 35 U.S.C. § 103(a) as obvious over U.S. Patent No. 2,923,535 to Ljungstrom (hereinafter "Ljungstrom"). Applicant respectfully disagrees with the rejections.

Independent claims 2309 and 2348 have been amended to include the feature: "controlling the heat such that an average heating rate of the part of the formation is less than about 1 °C per day in a pyrolysis temperature range". Applicant submits that Ljungstrom does not appear to teach or suggest the above-quoted feature. Applicant respectfully requests removal of the rejections of claims 2309, and 2348.

Amended claim 5160 describes a combination of features including: "inhibiting introduction of oxygen or air into the part when temperature in the part is in a pyrolysis temperature range". Support for the amendment may be found in the specification at least at page 69, lines 10-12, which state: "Thus, it is often useful to allow heat to transfer from the reaction zone to the pyrolysis zone while inhibiting or preventing oxidation product and/or oxidation fluid from reaching the pyrolysis zone." In this context, pyrolysis zone is equivalent to "part" in claim 5160, and the reaction zone is equivalent to "portion" in claim 5160.

Ljungstrom appears to teach and/or suggest a need to introduce air and/or oxygen into the formation. Ljungstrom states: "According to the invention, it is thus necessary to subject some of the fuel carrying layers to electrical heating, whereas the remainder or the major portion thereof are gasified during the subsequent gasification by means of oxygen or air ...." (column 3, lines 37-41.

At least the above quoted feature of claim 5160, in combination with the other features of the claim does not appear to be taught or suggested by the cited art. In addition, Ljungstrom does not appear to teach or suggest "controlling the heat to yield at least about 15% by weight of a total organic carbon content of the part of the formation into condensable hydrocarbons." The treatment of the formation by introducing air and/or oxygen into the formation as taught and/or suggested by Ljungstrom would not appear to teach or suggest a system capable of the quoted feature. Applicant requests removal of the rejection of claim 5160 and the claims dependent thereon.

If an independent claim is nonobvious under 35 U.S.C. 103, then any claim depending therefrom is nonobvious. *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988). Applicant respectfully requests removal of the rejections of claims 2310, 2311, 2316, 2319, 2321-2331, 2333, 2334, 2342-2344, 2349, 2350, 2355, 2358, 2360-2370, 2372, 2373, 2181, 2382, 5151-5154, 5156-5159, 5161-5163, 5165, 5166, and 5168-5170.

F. The Claims Are Not Unpatentable Over Ljungstrom Pursuant To 35 U.S.C. § 103(a)

The Examiner rejected claims 2317, 2318, 2320, 2335, 2338, 2344, 2345, 2356, 2357, 5167, 2374, 2377, 2383, 5150, 5155, 5167, and 5171 as being unpatentable over Ljungstrom pursuant to 35 U.S.C. § 103(a). Applicant respectfully disagrees with the rejections.

To establish *prima facie* obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art. *In re Royka*, 490 F.2d 981 (CCPA 1974), MPEP § 2143.03.

The Examiner states: "The precise heating rate and/or thermal conductivity recited in claims 2317, 2318, 2356, 2357 and 5167 are deemed obvious matters of choice or design, especially in carrying out the embodiment in Ljungstrom of controlling and/or maintaining the temperature in the hydrocarbon formation within a specific operating range." Applicant respectfully disagrees that the precise heating rate and/or thermal conductivity are obvious matters of choice or design.

Regarding heating rate, Ljungstrom appears only to state: "The heat was supplied continuously during about seven months, whereby the shale layer was heated to an average temperature of 400° C." Amended independent claims 2309 and 2348 describe a combination of features including: "controlling the heat such that an average heating rate of the part of the formation is less than about 1 °C per day in a pyrolysis temperature range". Ljungstrom does not appear to teach or suggest controlling the heat such that an average heating rate of a part of a formation is less than about 1 °C per day in a pyrolysis temperature range.

Applicant submits that claims 2309, 2348, 5160, and the claims dependent thereon are in condition for allowance. Applicant therefore requests removal of the rejections of dependent claims 2318, 2320, 2335, 2338, 2344, 2345, 2357, 5167, 2374, 2377, 2383, 5150, 5155, 5167, and 5171. Applicant further believes that many of the claims dependent on claims 2309, 2348, and 5160 are separately patentable.

Amended claims 2318, 2357, and 5167 describe a combination of features including: "wherein heating energy/day (*Pwr*) provided to the selected volume is equal to or less than $h*V*C_v*\rho_B$, wherein ρ_B is formation bulk density, and wherein an average heating rate (h) of the selected volume is about 10 °C/day." Applicant's Specification discloses: "In an alternative embodiment, at least a portion of the formation may be heated to a temperature such that at least a portion of the hydrocarbon containing formation may be converted to coke and/or char. Coke and/or char may be formed at temperatures above about 400 °C and at a high heating rate (e.g., above about 10 °C/day)." (Specification, page 71, lines 4-7) The recited heating rate appears to have criticality and/or unexpected results not taught or suggested by the cited art. Applicant submits that Ljungstrom does not appear to teach or suggest using a desired heating rate to calculate a maximum average heating energy/day to be applied to a selected volume of a formation. Applicant respectfully requests removal of the rejections of claims 2318, 2357, and 5167.

Amended claims 2320 and 2359 describe a combination of features including: "wherein allowing the heat to transfer from the one or more heat sources to the part of the formation increases a thermal conductivity of at least a portion of the part of the formation to greater than about 0.5 W/(m °C)." Applicant submits that providing heat from one or more heaters such that a thermal conductivity of a portion of a formation is greater than about 0.5 W/(m °C) is unexpected based on literature in the art. For example, Applicant's Specification states:

> Certain embodiments described herein will in many instances be able to economically treat formations that were previously believed to be uneconomical. Such treatment will be possible because of the surprising increases in thermal conductivity and thermal diffusivity that can be achieved with such embodiments. These surprising results are illustrated by the fact that prior literature indicated that certain hydrocarbon containing formations, such as coal, exhibited relatively low values for thermal conductivity and thermal diffusivity when heated. For example, in government report No. 8364 by J. M. Singer and R. P. Tye entitled "Thermal, Mechanical, and Physical Properties of Selected Bituminous Coals and Cokes," U.S. Department of the Interior, Bureau of Mines (1979), the authors report the thermal conductivity and thermal diffusivity for four bituminous coals. This government report includes graphs of thermal

> conductivity and diffusivity that show relatively low values up to about 400 °C (e.g., thermal conductivity is about 0.2 W/(m °C) or below, and thermal diffusivity is below about 1.7 x 10^{-3} cm^2/s). This government report states that 'coals and cokes are excellent thermal insulators.'
>
> In contrast, in certain embodiments described herein hydrocarbon containing resources (e.g., coal) may be treated such that the thermal conductivity and thermal diffusivity are significantly higher (e.g., thermal conductivity at or above about 0.5 W/(m °C) and thermal diffusivity at or above 4.1 x 10^{-3} cm^2/s) than would be expected based on previous literature such as government report No. 8364. If treated as described in certain embodiments herein, coal does not act as 'an excellent thermal insulator.' Instead, heat can and does transfer and/or diffuse into the formation at significantly higher (and better) rates than would be expected according to the literature, thereby significantly enhancing economic viability of treating the formation. (Specification, page 136, line 8-29)

Applicant submits that allowing the heat to transfer from the one or more heat sources to the part of the formation to increase thermal conductivity of at least a portion of the part to greater than about 0.5 W/(m °C) is not an obvious matter of choice or design. Applicant respectfully requests removal of the rejections of claims 2320 and 2359.

The Examiner states:

> Regarding claims 2345, 2383, 5150 and 5155, Ljungstrom in the embodiment of Figures 2-5 and 9, discloses that myriad heating wellbores (20) may surround a production wellbore or shaft (26). The precise number of such heating wells provided, as called for in these claims, is deemed an obvious matter of choice or design in carrying out the process of Ljungstrom based on, e.g., the overall areal extent of the hydrocarbon formation(s) encountered in exploiting an actual reservoir encountered in the field.

Ljungstrom discloses:

> Electrical heating elements 22 may be arranged in holes 20 in groups comprising six elements about a common gas exhaust passage 26, as will appear from Figures 2-5. (Ljungstrom, column 2, lines 65-68)

Ljungstrom further discloses:

> In the holes in the corners of the hexagons were inserted electrical heating elements. A power of 10 kilowatts was evenly distributed over the part of the element, which was placed in the oil shale. (Ljungstrom, column 4, lines 49-53)

Ljungstrom does not appear to provide any suggestion or motivation for using 7 or more heaters per production well.

Applicant submits that the selection of the number of heater wells provided for a production well is not an obvious matter of choice or design but, rather, may be based upon non-obvious choices such as desired product composition, desired production rates, desired heating rates, etc. Claims 2345 and 2383 describe a combination of features including: "producing a mixture in a production well, and wherein at least about 7 heat sources are disposed in the formation for each production well." At least the above-quoted features of claims 2345 and 2383, in combination with other features of the claims, do not appear to be taught or suggested by the cited art. Claims 5150 and 5155 describe a combination of features including: "wherein at least about 20 heat sources are disposed in the formation for each production well." At least the above-quoted feature of claims 5150 and 5155, in combination with other features of the claims, does not appear to be taught or suggested by the cited art.

G. The Claims Are Not Obvious Over Ljungstrom In View of Tsai Pursuant To 35 U.S.C. 103(a)

The Examiner rejected claims 2332, 2336, 2337, 2371, 2375, and 2376 as unpatentable under 35 U.S.C. § 103(a) over Ljungstrom "as applied to claims 412 and 452 above" in view of U.S. Patent No. 4,299,285 to Tsai et al. (hereinafter "Tsai"). Applicant respectfully disagrees with the rejections.

The Examiner states:

> While Ljungstrom does not disclose the presence of hydrogen in a coal or oil shale heating production effluent, Tsia et al. (col. 5, line 52 – col. 6, line 15) clearly discloses that gasification/volatilization products resulting from heating and/or gasifying a coal formation include hydrogen.
>
> Accordingly, it is deemed that the volatilized/gasified coal production effluent produced in the process of Ljungstrom will obviously include a hydrogen component, as taught by Tsai et al, with the precise amount of hydrogen present, as called for in claims 2332, 2336, 2371, and 2375....

Tsai states: "The net result is a combustible product gas comprising carbon monoxide, hydrogen and some methane as its principal combustibles...." (Tsai, col. 5, lines 55-58) Applicant submits that the Examiner's statement "that the...effluent produced in the process of Ljungstrom will obviously include a hydrogen component...with the precise amount of hydrogen present, as called for in claims 2332, 2336, 2371, and 2375...." is extending the teaching of Tsai.

Amended claims 2332 and 2371 describe a combination of features including: "producing a mixture from the formation, wherein the produced mixture comprises a non-condensable component, wherein the non-condensable component comprises molecular hydrogen, wherein the molecular hydrogen is greater than about 10 % by volume of the non-condensable component at 25 °C and one atmosphere absolute pressure, and wherein the molecular hydrogen is less than about 80 % by volume of the non-condensable component at 25 °C and one atmosphere absolute pressure." Applicant submits that the combination of the cited art does not appear to teach or suggest the range of molecular hydrogen content by volume percent recited in claims 2332 and 2371. Applicant respectfully requests removal of the rejections of claims 2332 and 2371.

Claims 2336 and 2375 describe a combination of features including: "controlling formation conditions to produce a mixture from the formation, wherein a partial pressure of H_2 within the mixture is greater than about 0.5 bar." Applicant submits that the combination of the cited art does not appear to teach or suggest controlling formation conditions to produce a mixture from the formation, wherein a partial pressure of H_2 within the mixture is greater than about 0.5 bar. Applicant respectfully requests removal of the rejections of claims 2336 and 2375.

H. The Claims Are Not Obvious Over Ljungstrom In View of Justheim Pursuant To 35 U.S.C. 103(a)

The Examiner rejected claims 2332, 2336, 2337, 2339, 2340, 2371, 2375, 2376, 2378, and 2379 as being unpatentable under 35 U.S.C. § 103(a) over Ljungstrom "as applied to claims 412 [2309] and 452 [2348] above," and further in view of U.S. Patent No. 3,766,982 to Justheim (hereinafter "Justheim"). Applicant respectfully disagrees with the rejections.

The Examiner states:

> As per claims 2332, 2336, 2371 and 2375, in carrying out the injection of hydrogen into the coal formation to effect hydrogenation of the volatilized/pyrolyzed hydrocarbons evolved, in the modified process of Ljungstrom, the production fluids actually produced will necessarily or obviously include a partial pressure of hydrogen, with the precise amount thereof deemed an obvious matter of choice or design....

Amended claims 2332 and 2371 describe a combination of features including: "producing a mixture from the formation, wherein the produced mixture comprises a non-condensable component, wherein the non-condensable component comprises molecular hydrogen, wherein the molecular hydrogen is greater than about 10 % by volume of the non-condensable component at 25 °C and one atmosphere absolute pressure, and wherein the molecular hydrogen is less than about 80 % by volume of the non-condensable component at 25 °C and one atmosphere absolute pressure."

Claims 2336 and 2375 describe a combination of features including: "controlling formation conditions to produce a mixture from the formation, wherein a partial pressure of H_2 within the mixture is greater than about 0.5 bar."

Applicant submits that the Examiner is extending the teaching of Justheim in the rejections of claims 2332, 2336, 2371, and 2375 to include a specific content of a component in a

produced mixture (e.g., a partial pressure of H_2 within the mixture greater than about 0.5 bar; greater than about 10 % by volume and less than about 80% by volume of the non-condensable component). Applicant submits that the combination of the cited art does not appear to teach or suggest achieving a specific content of hydrogen in a produced mixture. Applicant respectfully requests removal of the rejections of claims 2332, 2336, 2371, and 2375.

I. Conclusion

Applicant submits that all claims are in condition for allowance. Favorable reconsideration is respectfully requested.

A Fee Authorization is enclosed to cover a one-month extension of time. If any further extension of time is required, Applicant hereby requests the appropriate extension of time. If any additional fees are required or if fees have been overpaid, please charge or credit those fees to Meyertons, Hood, Kivlin, Kowert & Goetzel, P.C. Deposit Account Number 50-1505/5659-06100/EBM.

Respectfully submitted,

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Date: 3/25/03

Marked-Up Version of Amendments Submitted With Amendment; Response To Office Action Mailed November 25, 2002

In the Claims:

2309. (amended) A method of treating a coal formation in situ, comprising:

providing heat from one or more heat sources to at least a portion of the formation;

allowing the heat to transfer from one or more of the heat sources to a part of the formation; ~~and~~

controlling the heat such that an average heating rate of the part of the formation is less than about 1 °C per day in a pyrolysis temperature range; and

controlling the heat to yield at least about 15 % by weight of a total organic carbon content of the part of the formation into condensable hydrocarbons.

2310. (amended) The method of claim 2309, wherein the one or more ~~of the~~ heat sources comprise at least two heat sources, and wherein superposition of heat from at least the two heat sources pyrolyzes at least some hydrocarbons within the part of the formation.

2311. (amended) The method of claim 2309, further comprising maintaining a temperature within the part of the formation within a pyrolysis temperature range of about 270 °C to about 400 °C.

2318. (amended) The method of claim 2309, wherein providing heat from one or more of the heat sources to at least the portion of the formation comprises:

heating a selected volume (V) of the coal formation from one or more of the heat sources, wherein the formation has an average heat capacity (C_v), and wherein the heating pyrolyzes at least some hydrocarbons within the selected volume of the formation; and

wherein heating energy/day *(Pwr)* provided to the selected volume is equal to or less than $h*V*C_v*\rho_B$, wherein ρ_B is formation bulk density, and wherein an average heating rate *(h)* of the selected volume is about 10 °C/day.

2320. (amended) The method of claim 2309, wherein ~~providing heat from one or more of the heat sources comprises heating the part of the formation such that~~allowing the heat to transfer from one or more of the heat sources to the part of the formation increases a thermal conductivity of at least a portion of the part of the formation ~~is~~ to greater than about 0.5 W/(m °C).

2332. (amended) The method of claim 2309, further comprising producing a mixture from the formation, wherein the produced mixture comprises a non-condensable component, wherein the non-condensable component comprises molecular hydrogen, wherein the molecular hydrogen is greater than about 10 % by volume of the non-condensable component at 25 °C and one atmosphere absolute pressure, and wherein the molecular hydrogen is less than about 80 % by volume of the non-condensable component at 25 °C and one atmosphere absolute pressure.

2340. (amended) The method of claim 2309, further comprising:

providing hydrogen (H_2) to the heated part of the formation~~section~~ to hydrogenate hydrocarbons within the part~~section~~; and

heating a portion of the part~~section~~ with heat from hydrogenation.

2341. (amended) The method of claim 2309, further comprising:

producing hydrogen (H_2) and condensable hydrocarbons from the formation; and

hydrogenating a portion of the produced condensable hydrocarbons with at least a portion of the produced hydrogen.

2342. (amended) The method of claim 2309, wherein allowing the heat to transfer ~~comprises increasing~~increases a permeability of a majority of the part of the formation to greater than about 100 millidarcy.

2343. (amended) The method of claim 2309, wherein allowing the heat to transfer ~~comprises substantially uniformly increasing~~ increases a permeability of a majority of the part of the formation~~,~~ such that the permeability of the majority of the part of the formation is substantially uniform.

2348. (amended) A method of treating a coal formation in situ, comprising:

providing heat from one or more heat sources to at least a portion of the formation;

allowing the heat to transfer from one or more of the heat sources to a part of the formation; ~~and~~

controlling the heat such that an average heating rate of the part of the formation is less than about 1 °C per day in a pyrolysis temperature range; and

controlling the heat to yield greater than about 60 % by weight of total condensable hydrocarbons, as measured by Fischer Assay.

2349. (amended) The method of claim 2348, wherein the one or more ~~of the~~ heat sources comprise at least two heat sources, and wherein superposition of heat from at least the two heat sources pyrolyzes at least some hydrocarbons within the part of the formation.

2350. (amended) The method of claim 2348, further comprising maintaining a temperature within the part of the formation within a pyrolysis temperature range of about 270 °C to about 400 °C.

2357. (amended) The method of claim 2348, wherein providing heat from one or more of the heat sources to at least the portion of the formation comprises:

heating a selected volume (V) of the coal formation from one or more of the heat sources, wherein the formation has an average heat capacity (C_v), and wherein the heating pyrolyzes at least some hydrocarbons within the selected volume of the formation; and

wherein heating energy/day *(Pwr)* provided to the selected volume is equal to or less than $h*V*C_v*\rho_B$, wherein ρ_B is formation bulk density, and wherein an average heating rate (h) of the selected volume is about 10 °C/day.

2359. (amended) The method of claim 2348, wherein ~~providing~~ allowing the heat to transfer from one or more of the heat sources ~~comprises heating the part of the formation such~~ to the part of the formation ~~that~~increases a thermal conductivity of at least a portion of the part of the formation ~~is~~ to greater than about 0.5 W/(m °C).

2371. (amended) The method of claim 2348, further comprising producing a mixture from the formation, wherein the produced mixture comprises a non-condensable component, wherein the non-condensable component comprises molecular hydrogen, wherein the molecular hydrogen is greater than about 10 % by volume of the non-condensable component at 25 °C and one atmosphere absolute pressure, and wherein the molecular hydrogen is less than about 80 % by volume of the non-condensable component at 25 °C and one atmosphere absolute pressure.

2378. (amended) The method of claim 2348, further comprising producing a mixture from the formation and controlling formation conditions by recirculating a portion of hydrogen (H_2) from the mixture into the formation.

2379. (amended) The method of claim 2348, further comprising:

providing hydrogen (H_2) to the heated partsection to hydrogenate hydrocarbons within the partsection; and

heating a portion of the partsection with heat from hydrogenation.

2380. (amended) The method of claim 2348, further comprising:

producing hydrogen (H_2) and condensable hydrocarbons from the formation; and

hydrogenating a portion of the produced condensable hydrocarbons with at least a portion of the produced hydrogen.

2381. (amended) The method of claim 2348, wherein allowing the heat to transfer ~~comprises increasing~~increases a permeability of a majority of the part of the formation to greater than about 100 millidarcy.

2382. (amended) The method of claim 2348, wherein allowing the heat to transfer comprises ~~substantially uniformly~~ increasing a permeability of a majority of the part of the formation such that the permeability of the majority of the part of the formation is substantially uniform.

5152. (amended) The method of claim 2309, wherein a pyrolysis zone is established in the part of the formation ~~comprises a pyrolysis zone~~.

5153. (amended) The method of claim 2309, wherein a pyrolysis zone is established in the part of the formation ~~comprises a pyrolysis zone~~ proximate to and/or surrounding at least one of the heat~~ers~~ sources.

5154. (amended) The method of claim 2309, wherein at least one of the ~~heaters~~ heat sources is disposed in an open wellbore.

5157. (amended) The method of claim 2348, wherein a pyrolysis zone is established in the part of the formation ~~comprises a pyrolysis zone~~.

5158. (amended) The method of claim 2348, wherein a pyrolysis zone is established in the part of the formation ~~comprises a pyrolysis zone~~ proximate to and/or surrounding at least one of the heat~~ers~~ sources.

5159. (amended) The method of claim 2348, wherein at least one of the ~~heaters~~heat sources is disposed in an open wellbore.

5160. (amended) A method of treating a coal formation in situ, comprising:

providing heat from one or more heat sources to at least a portion of the formation, wherein the heated portion of the formation is proximate one or more of the heat ~~source~~sources;

allowing the heat to transfer from the portion of the formation to a part of the formation; ~~and~~

inhibiting introduction of oxygen or air into the part when temperature in the part is in a pyrolysis temperature range;

controlling the heat to yield at least about 15 % by weight of a total organic carbon content of the part of the formation into condensable hydrocarbons.

5161. (amended) The method of claim 5160, wherein the one or more ~~of the~~ heat sources comprise at least two heat sources, and wherein superposition of heat from at least the two heat sources pyrolyzes at least some hydrocarbons within the part of the formation.

5163. (amended) The method of claim 5160, wherein a pyrolysis zone is established in the part of the formation ~~comprises a pyrolysis zone~~.

5164. (amended) The method of claim 5160, wherein at least one of the heat sources ~~comprise~~ comprises a natural distributed ~~combustors~~combustor.

5166. (amended) The method of claim 5160, wherein allowing the heat to transfer ~~comprises substantially uniformly increasing~~ increases a permeability of a majority of the part of the formation such that the permeability of the majority of the part of the formation is substantially uniform.

5167. (amended) The method of claim 5160, wherein providing heat from one or more of the heat sources to at least the portion of the formation comprises:

heating a selected volume (V) of the coal formation from one or more of the heat sources, wherein the formation has an average heat capacity (C_v), and wherein the heating pyrolyzes at least some hydrocarbons within the selected volume of the formation; and

_____wherein heating energy/day *(Pwr)* provided to the selected volume is equal to or less than $h*V*C_v*\rho_B$, wherein ρ_B is formation bulk density, and wherein an average heating rate (h) of the selected volume is about 10 °C/day.